United States Patent [19]

D'Amato et al.

[11] **4,187,443**

[45] **Feb. 5, 1980**

[54] **COLOR PICTURE TUBE HAVING IMPROVED CORRUGATED APERTURED MASK AND METHOD OF MAKING SAME**

[75] Inventors: **Ralph J. D'Amato; Richard A. Nolan,** both of Lancaster, Pa.

[73] Assignee: **RCA Corporation,** New York, N.Y.

[21] Appl. No.: **940,570**

[22] Filed: **Sep. 8, 1978**

[51] **Int. Cl.**[2] **B23P 15/16;** H01J 9/14; H01J 29/07

[52] **U.S. Cl.** ..... **313/402;** 29/25.18; 29/163.5 R; 313/407

[58] **Field of Search** ..... 313/402, 403, 407; 29/25.18, 163.5 R

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,600,213	8/1971	Arndt	313/402 X
3,909,928	10/1975	Sato et al.	313/402 X
4,072,876	2/1978	Morrell	313/403
4,122,368	10/1978	Masterton	313/403

FOREIGN PATENT DOCUMENTS

458183	3/1928	Fed. Rep. of Germany	29/163.5 R
49-141754	12/1974	Japan	313/403
52-57776	5/1977	Japan	313/407

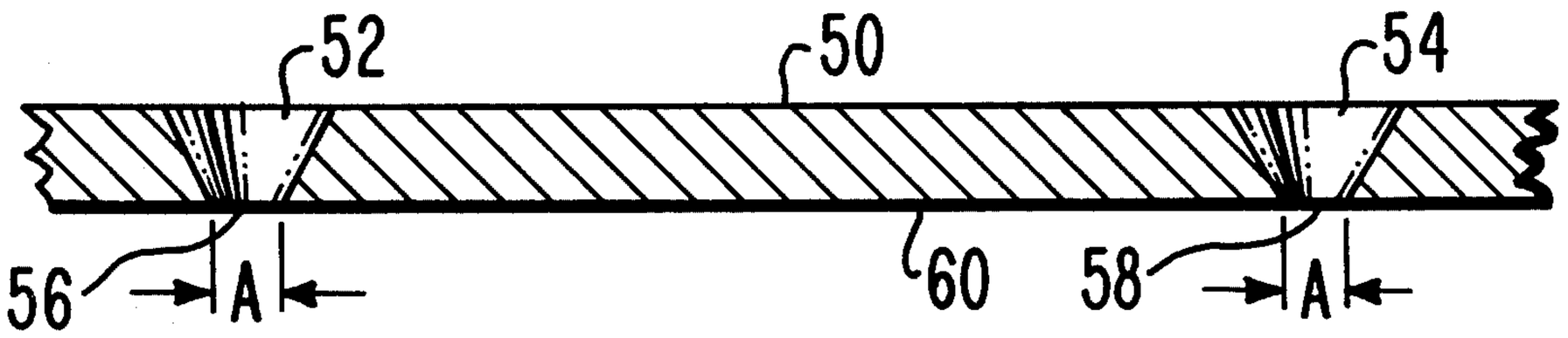
Primary Examiner—Palmer C. Demeo

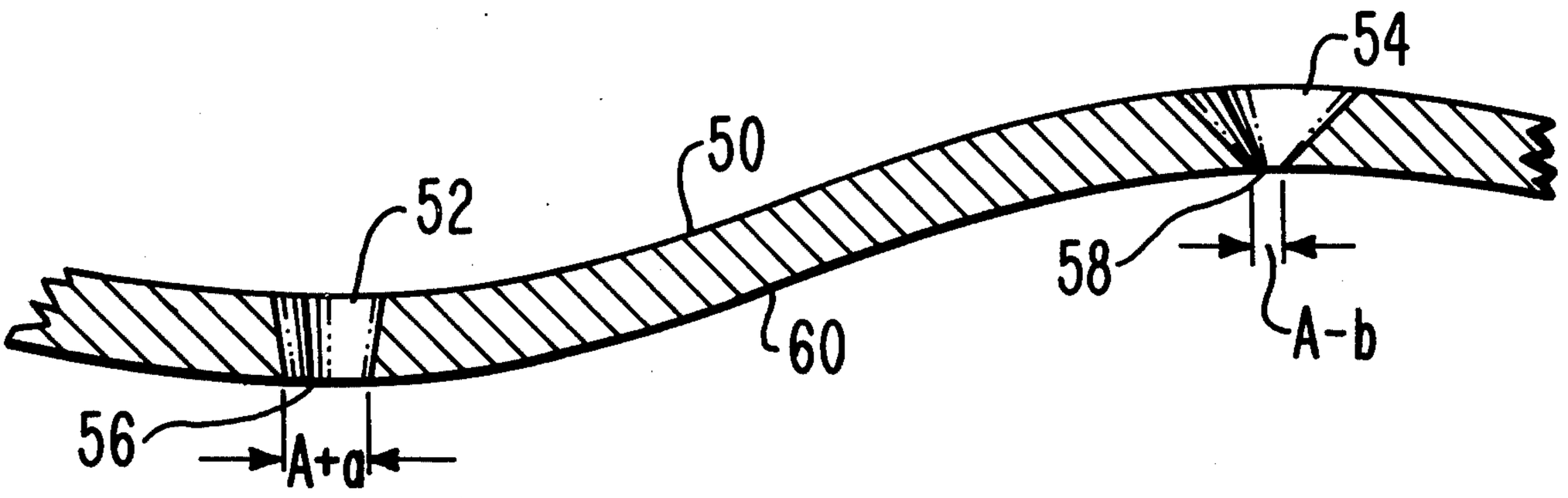
Attorney, Agent, or Firm—Eugene M. Whitacre; Glenn H. Bruestle; Dennis H. Irlbeck

[57] **ABSTRACT**

The present invention provides an improvement in an apertured mask type color picture tube having a faceplate, a cathodoluminescent screen on the faceplate, a corrugated apertured mask adjacent the screen and an electron gun means for producing and directing a plurality of electron beams through the mask to impinge upon the screen. The mask is constructed by first forming the apertures therein and thereafter forming the mask in a corrugated shape. Aperture width in the apertured but unformed mask is adjusted to compensate for stretching and compression of the mask occurring during formation of the mask into a corrugated shape. Therefore, the corrugated mask is substantially free of aperture width variation from that desired caused by forming the mask in a corrugated shape.

6 Claims, 6 Drawing Figures





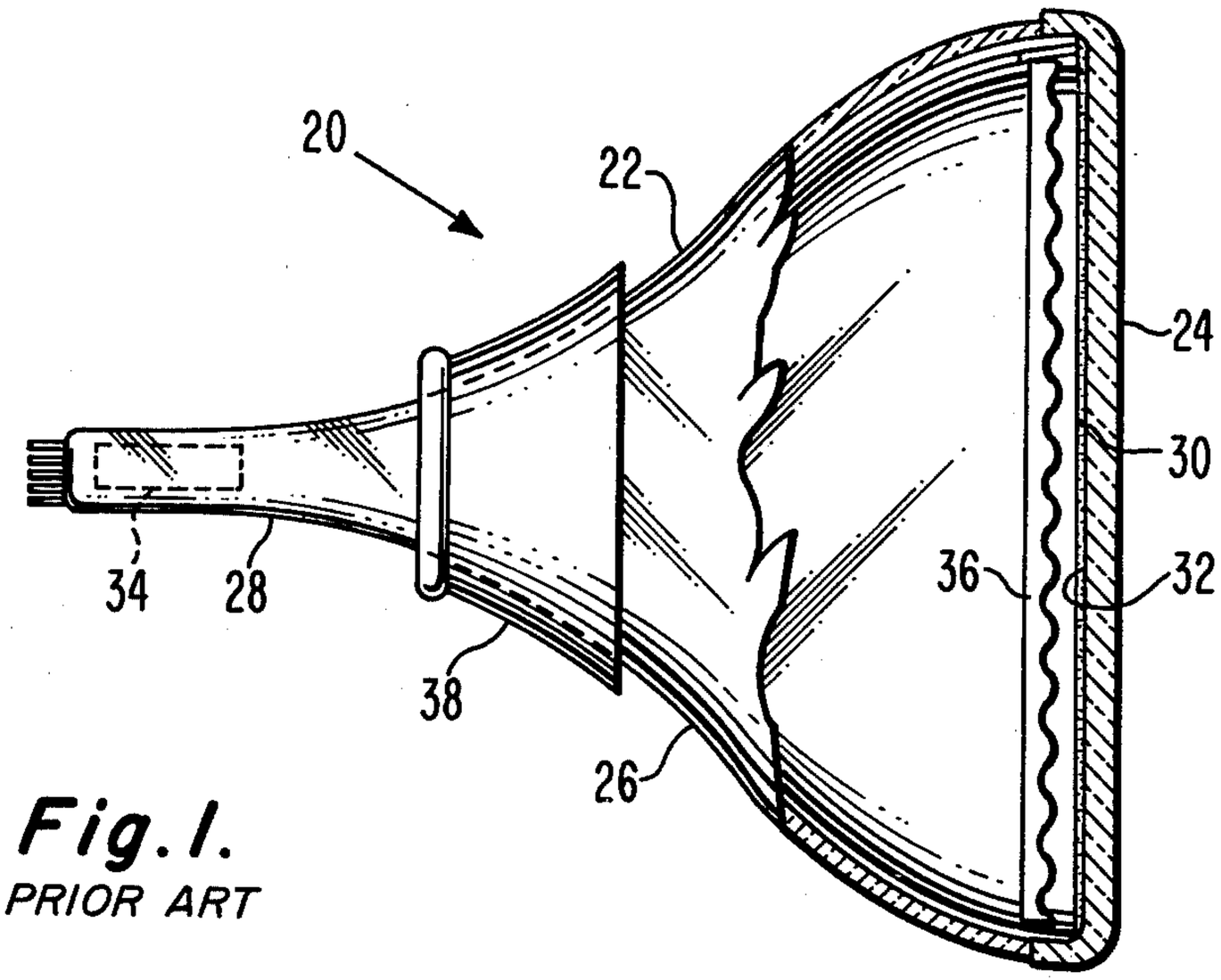


Fig. 1.
PRIOR ART

Fig. 2.
PRIOR ART

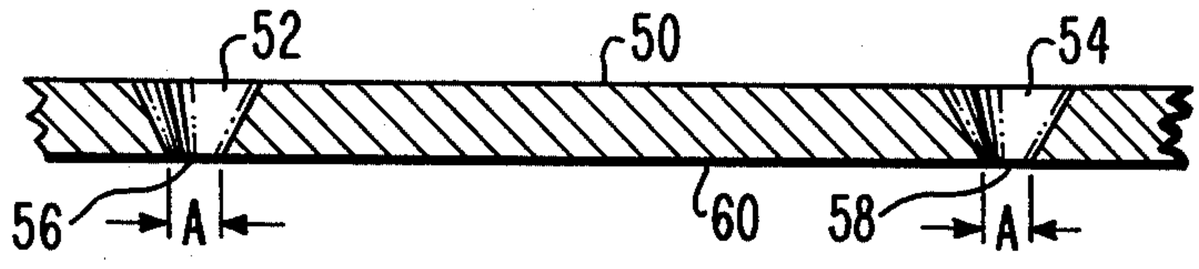


Fig. 3.

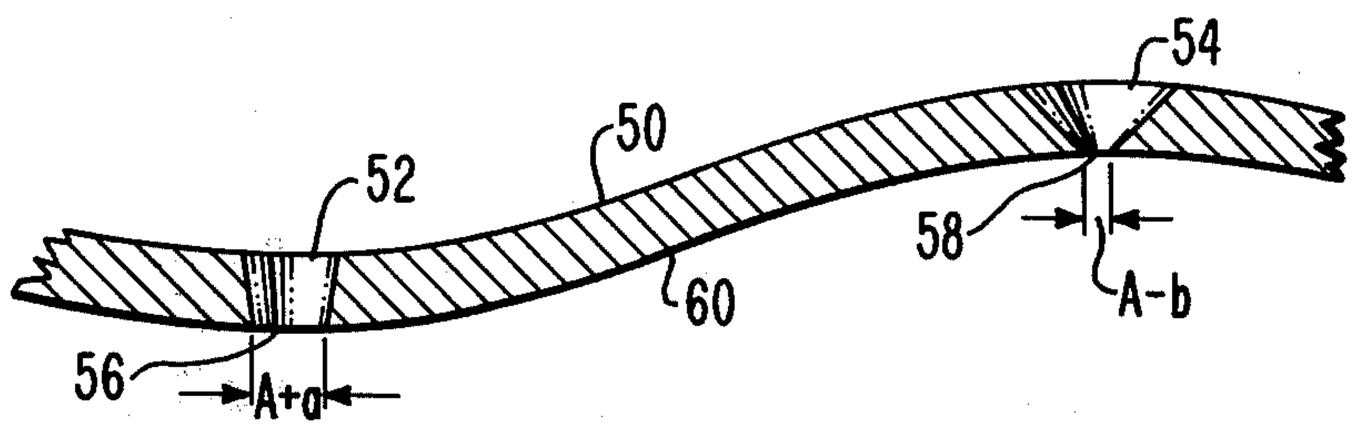


Fig. 4.

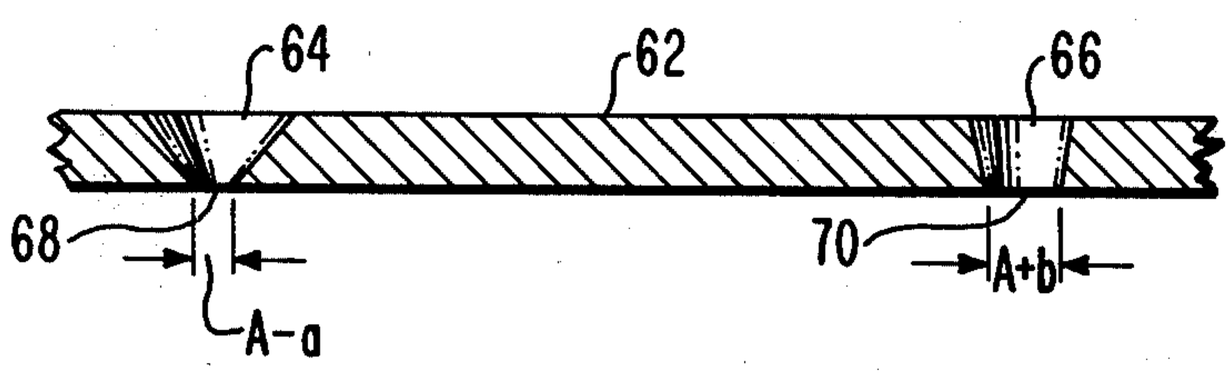


Fig. 5.

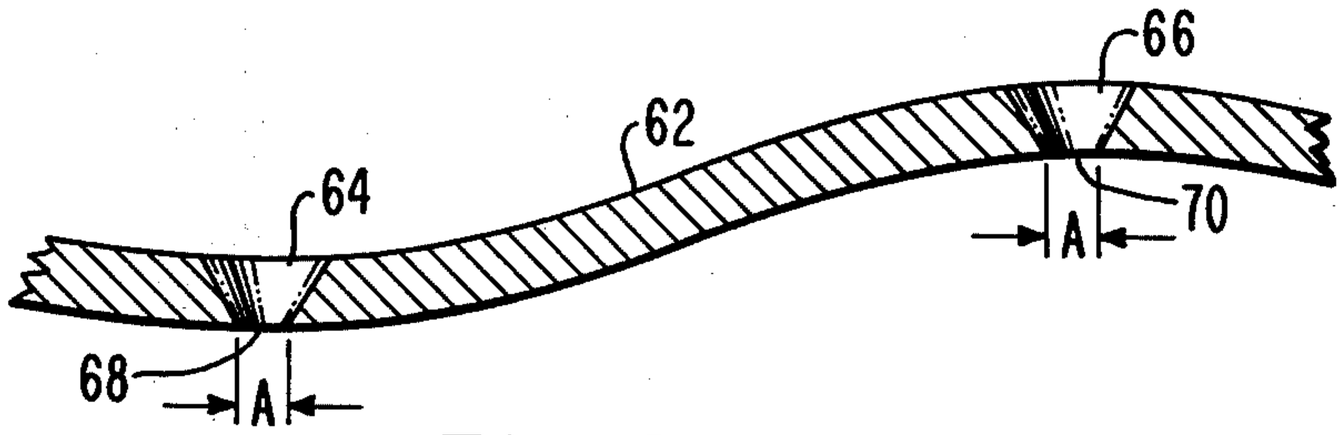


Fig. 6.

COLOR PICTURE TUBE HAVING IMPROVED CORRUGATED APERTURED MASK AND METHOD OF MAKING SAME

BACKGROUND OF THE INVENTION

This invention relates to shadow mask type color picture tubes, and particularly to variations in the aperture patterns of shadow masks within such tubes having corrugated apertured masks.

In a recently suggested shadow mask type color picture tube disclosed in U.S. Pat. No. 4,072,876, issued to A. M. Morrell on Feb. 7, 1978, a mask corrugated in the horizontal direction is incorporated in combination with a flat or substantially flat faceplate. The apertures of the corrugated mask are slit-shaped and are aligned in vertical columns. In order to keep an acceptable pattern formation of the phosphor lines comprising the screen, the horizontal spacing between aperture columns and/or aperture width are varied as functions of the spacing variation between the mask and the screen. The present invention recognizes this prior art variation in aperture width and aperture column-to-aperture column spacing and provides another variation in aperture width in an apertured but unformed mask to compensate for deformation of the apertures that occur during formation of the mask into a corrugate shape.

SUMMARY OF THE INVENTION

The present invention provides an improvement in a corrugated apertured mask type color picture tube. Aperture width in the apertured but unformed mask is adjusted to compensate for stretching and compression of the mask occurring during formation of the mask into a corrugated shape. Therefore, the corrugated mask is substantially free of aperture width variation caused by forming the mask in a corrugated shape.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a partially cut-away top view of a color picture tube having a flat faceplate and a corrugated mask.

FIG. **2** is a perspective view of the mask-faceplate assembly of the tube of FIG. **1**.

FIG. **3** is a cross-sectional view of a portion of a simplified unformed shadow mask not incorporating an embodiment of the present invention.

FIG. **4** is a cross-sectional view of the mask of FIG. **3** after it has been formed.

FIG. **5** is a cross-sectional view of a portion of a simplified unformed shadow mask incorporating an embodiment of the present invention.

FIG. **6** is a cross-sectional view of the mask of FIG. **5** after it has been formed.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. **1** illustrates an apertured-mask color television picture tube **20** comprising an evacuated glass envelope **22** including a substantially rectangularly-shaped flat faceplate panel **24**, a funnel **26**, and a neck **28**. A three-color phosphor-viewing screen **30** is supported on the inner surface **32** of the faceplate panel **24**. An electron gun assembly **34**, positioned in the neck **28**, includes three electron guns (not shown), one for each of the three color phosphors on the viewing screen **30**. A rectangular corrugated apertured mask **36** is positioned in the envelope **22** adjacent the viewing screen **30**. The electron gun assembly **34** is adapted to project three electron beams through the apertured mask **36** to strike the viewing screen structure **30** with the mask **36** serving as a color selection electrode. A magnetic deflection yoke **38** is positioned on the envelope **22** near the intersection of the funnel **26** and the neck **28**. When suitably energized, the yoke **38** causes the electron beams to scan the screen **30** in a rectangular raster.

The apertured mask **36** further depicted in FIG. **2**, is corrugated in an undulatory manner, e.g. sinusoidally, along the horizontal or major axis (in the direction of the longer dimension of the mask) with the corrguations extending vertically in the direction of the minor axis (between long sides of the mask or in the direction of the shorter dimension of the mask). It should be understood that the term corrugated is herein defined broadly to include various undulatory shapes including a sawtooth, sinusoidal, and other curved shapes. Although the mask **36** is shown without any curvature along its major and minor axes, a mask having the same or different curvatures along these axes also is included within the scope of the present invention. Similarly, while the faceplate panel is shown as flat, it too may be curved along both major and minor axes.

The mask **36** includes a plurality of slit-shaped apertures aligned in vertical columns. In order to keep an acceptable line pattern on the screen, that is to maintain the desired brightness level and the spacing or nesting between the phosphor lines, aperture width and the horizontal spacing between aperture columns is generally varied as a function of the spacing between the mask **36** and the screen **30**. The peak-to-peak wavelength dimension of the corrugated variation in the mask should be at least twice as great as the spacing between adjacent aperture columns.

In order to illustrate the problem solved by the present invention, a portion of an apertured but unformed shadow mask **50** not including an embodiment of the present invention, is shown in FIG. **3** and the same portion of the same mask is shown after forming in FIG. **4**. The unformed mask **50** of FIG. **3** has two apertures **52** and **54** both of which have throats **56** and **58**, respectively, of equal width A. The throats **56** and **58** are on a side **60** of the mask **50** that will eventually face the electron guns in a completed tube. During formation, the mask side **50** in the vicinity of the first aperture **52** is bent convexly and in the vicinity of second aperture **54** is bent concavely. The convex bending causes a stretching of the throat **56** of the aperture **52** so that the aperture width at the throat **56** is enlarged to A+a. Conversely, the concave bending causes a compression of the throat **58** of the aperture **54** so that the aperture width at the throat **58** is reduced to A−b.

In the present invention, aperture width in the unformed mask is adjusted to account for this stretching and compression occurring during formation of a mask into a corrugated shape. FIG. **5** shows a portion of an apertured but unformed mask **62** having apertures **64** and **66** wherein the size of the apertures have been adjusted. In the unformed mask **62**, the aperture **64** has a throat **68** which is reduced to A−a and the aperture **66** has a throat **70** which is increased to A+b. Thereafter, when the mask **62** is formed into its corrugated shape, as shown in FIG. **6**, stretching of the aperture **64** enlarges its throat **68** to the desired width A and compression of the aperture **66** reduces its throat also to A. Therefore, the resultant mask is substantially free of

aperture width variation from that desired caused by forming the mask.

It should be understood that in a corrugated mask, aperture width is varied with mask-to-screen spacing and for various other reasons which are not the subject of the present invention. For reasons of simplification, these other factors which affect aperture width have been omitted from the foregoing preferred embodiment.

We claim:

1. In a method of constructing a corrugated mask for use in a color picture tube, wherein the mask is first apertured and thereafter formed into a corrugated shape, the improvement comprising,

in an unformed mask, forming the apertures in first locations with greater widths than the desired widths at the first locations and forming the apertures in second locations with lesser widths than the desired widths at the second locations, and

forming said mask into a corrugated shape such that the apertures in said first locations are compressed in width to the desired widths and the apertures in said second locations are stretched to the desired widths.

2. In a method of constructing a corrugated mask for use in a color picture tube wherein the mask is first apertured and thereafter formed into a corrugated shaped, the improvement comprising,

in an unformed mask, increasing the width of apertures in at least some locations that will be compressed and decreasing the width of apertures in at least some locations that will be stretched during formation of the mask into a corrugated shape, and

forming said mask into a corrugated shape such that the apertures of increased width are compressed in width and the apertures of decreased width are stretched in width.

3. A corrugated mask for use in a color picture tube constructed by the method of claim **2**.

4. In a method of constructing an apertured mask type color picture tube having a faceplate, a cathodoluminescent screen on the faceplate, a corrugated apertured mask adjacent the screen and electron gun means for producing a plurality of electron beams and directing said beams through said mask to impinge upon said screen wherein the mask corrugations are substantially parallel and extend in a first direction with the corrugated waveform extending in a second direction said mask including an aperture width variation in the second direction which is function of mask-to-screen spacing variations, and wherein said mask is constructed by first forming the apertures therein and thereafter forming said mask in a corrugated shape, the improvement comprising,

in an unformed mask, forming the apertures in first locations with greater widths than the desired widths at the first locations and forming the apertures in second locations with lesser widths than the desired widths at the second locations, and

forming said mask into a corrugated shape such that the apertures in said first locations are compressed in width to the desired widths and the apertures in said second locations are streched to the desired widths.

5. A color picture tube constructed by the method of claim **4**.

6. In a method of constructing a color picture tube having a corrugated apertured mask wherein each of the mask apertures has a larger surface opening on one side than on the opposite side, the surface openings on the opposite side constituting the throat of each aperture, the improvement comprising,

in an unformed mask, forming the throats in first locations with greater widths than the desired widths at the first locations and forming the throats in second locations with lesser widths than the desired widths at the second locations, and

forming said mask into a corrugated shape such that the throats in said first locations are compressed in width to the desired widths and the throats in said second locations are stretched to the desired widths.

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